

Digestive System

University of Jordan
Faculty of Medicine
Batch of 2013-2019



Slide Sheet Handout Other

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| <input type="checkbox"/> Physiology | <input checked="" type="checkbox"/> Histology |
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Sheet #: 2-lab Histology
Done by: Ibtehal Al-Hasanat

Date:
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Histology of the GIT

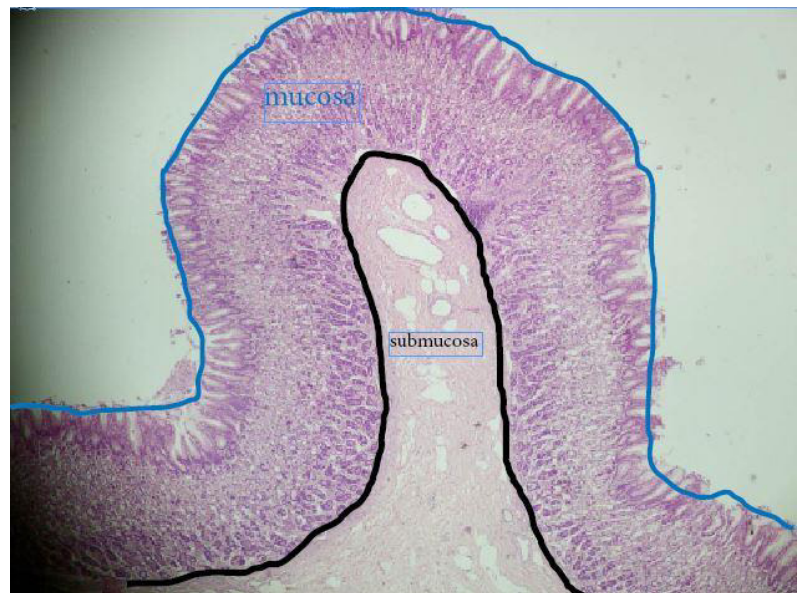
This is the last lecture in histology. Most of the information were mentioned in the previous lectures. The lecture covers the slides from 70 till the end of the set. I rearranged some repeated information.

Remember:

At the **cardioesophageal junction** - Esophago-gastric junction -the lining epithelium change from stratified squamous into simple columnar epithelium and the glands within the lamina propria change from cardiac glands into gastric glands.

Stomach:

- It has rugae which is invagination of submucosa through the mucosa.
- It has two types of rugae: transvers and longitudinal (close to lesser curvature for the passage of fluids)



Note: The wall in all regions of the stomach is made up of all 4 major layers (mucosa, submucosa (SM), muscularis externa (ME) and serosa).

* Mucosa:

- Contains 3 layers (surface epithelia, lamina propria and muscularis mucosa)
- The lining epithelium of the stomach is simple columnar epithelia without goblet cells.

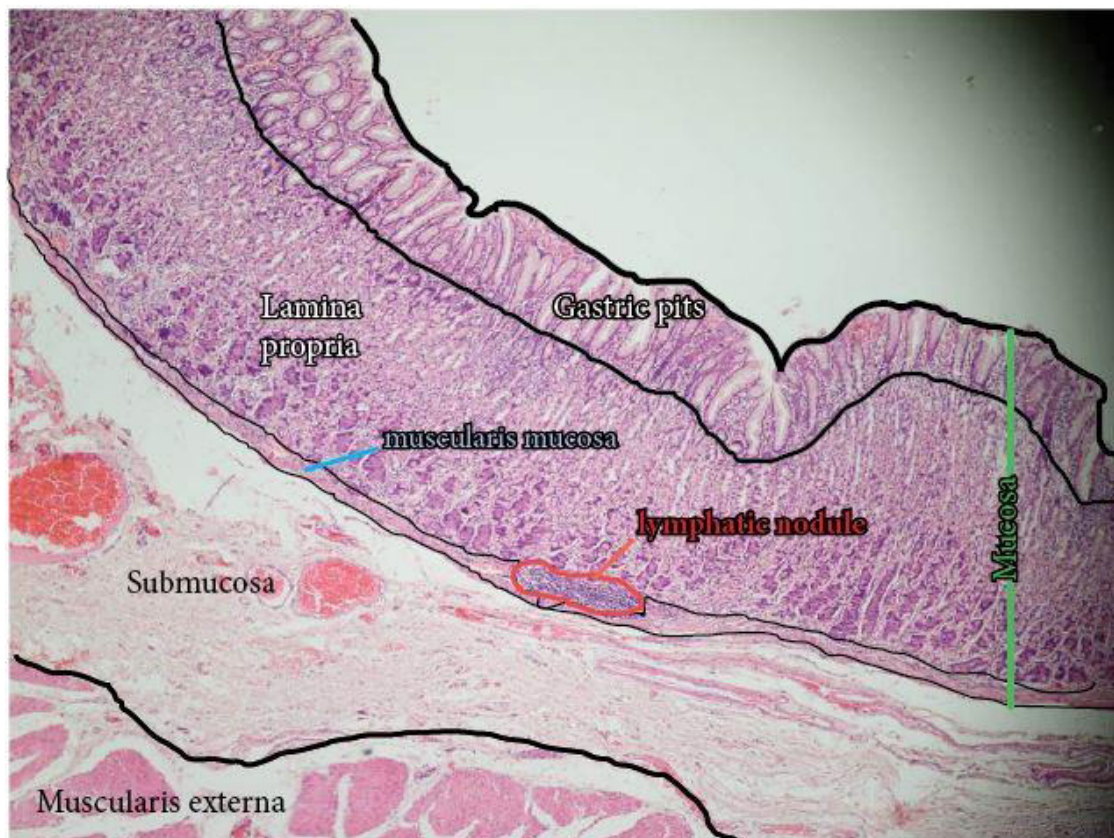
- It has gastric glands which are found in the lamina propria, gastric glands have gastric pits (ducts) that reach the surface to open there, isthmus, neck and base.
- Most of parietal cells (light in color) are found at the isthmus and the neck. Chief cells (dark in color) are found at the base and release pepsinogen.
- Sometime we find lymphatic nodules (aggregation of lymphocytes) in the lamina propria.

*** Submucosa:**

- Contains connective tissue, lymphatic and blood vessels.

*** Muscularis externa:**

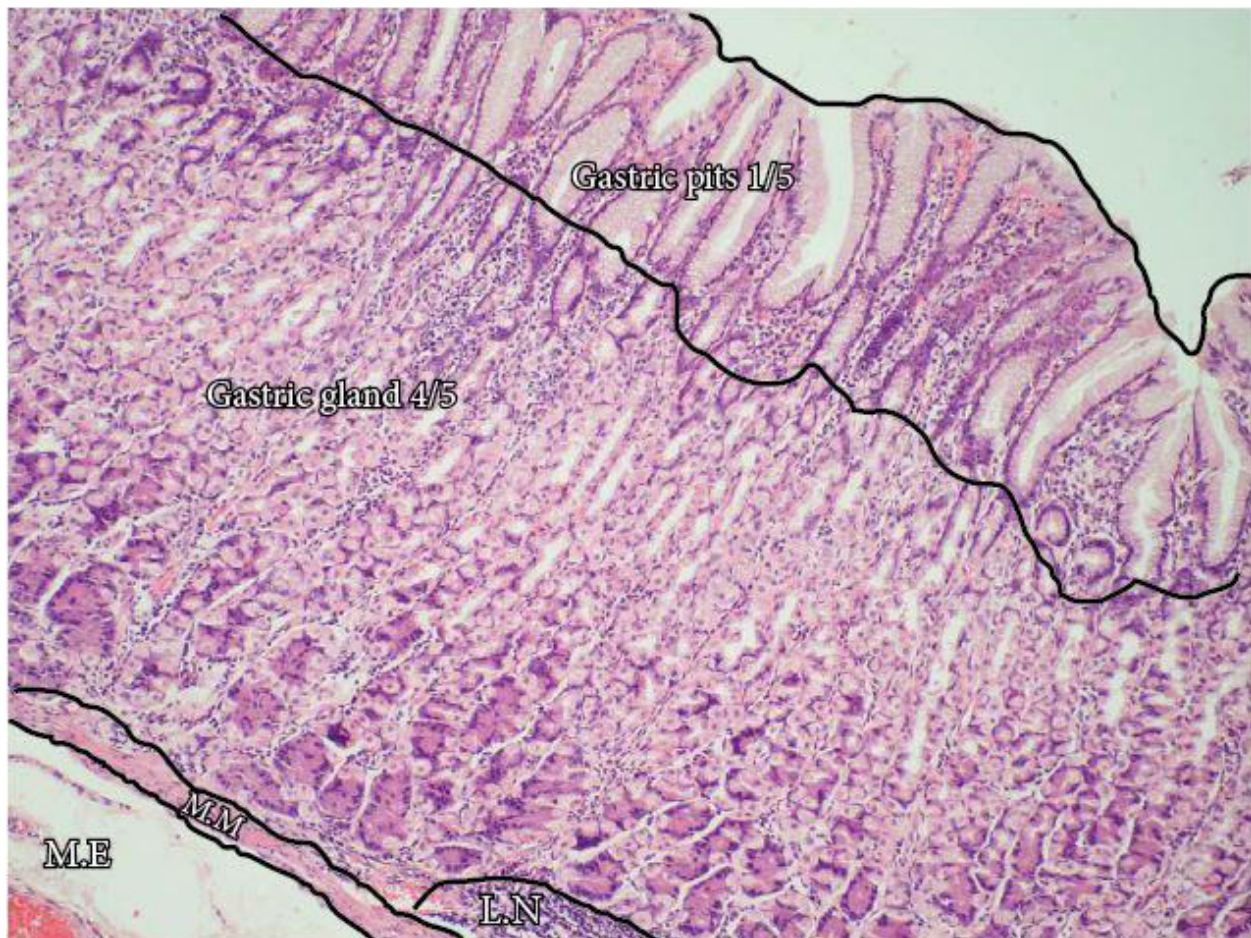
- The stomach has 3 layers of muscularis externa (inner circular, outer longitudinal and most inner oblique).



The stomach has 4 anatomical regions; cardia, fundus, body, and pylorus. The fundus and body are identical in their histology so **histologically** it has 3 parts; **cardia, fundus or body, and pylorus**. You have to differentiate between these 3 parts.

Fundus or Body

- The gastric glands take 4/5 of the mucosa of the fundus or body and the gastric pits take the last one fifth (1/5) (in comparison with the cardia; 1/2 of it is gastric glands and 1/2 gastric pits).



- The gastric glands are **simple branch tubular glands**.
- Each gland in the fundus or body has Parietal cells, Chief cells, Mucous cell, Endocrine cells and Stem cells.

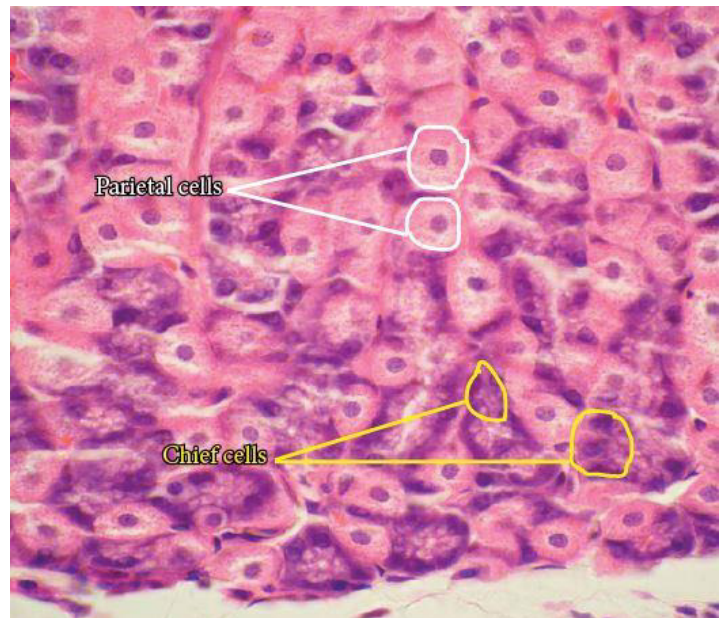
Parietal cells, Chief cells & Mucous cells → can be seen by light microscopy
Endocrine cells & Stem cells → can be seen by electron microscopy

* **Chief cells:**

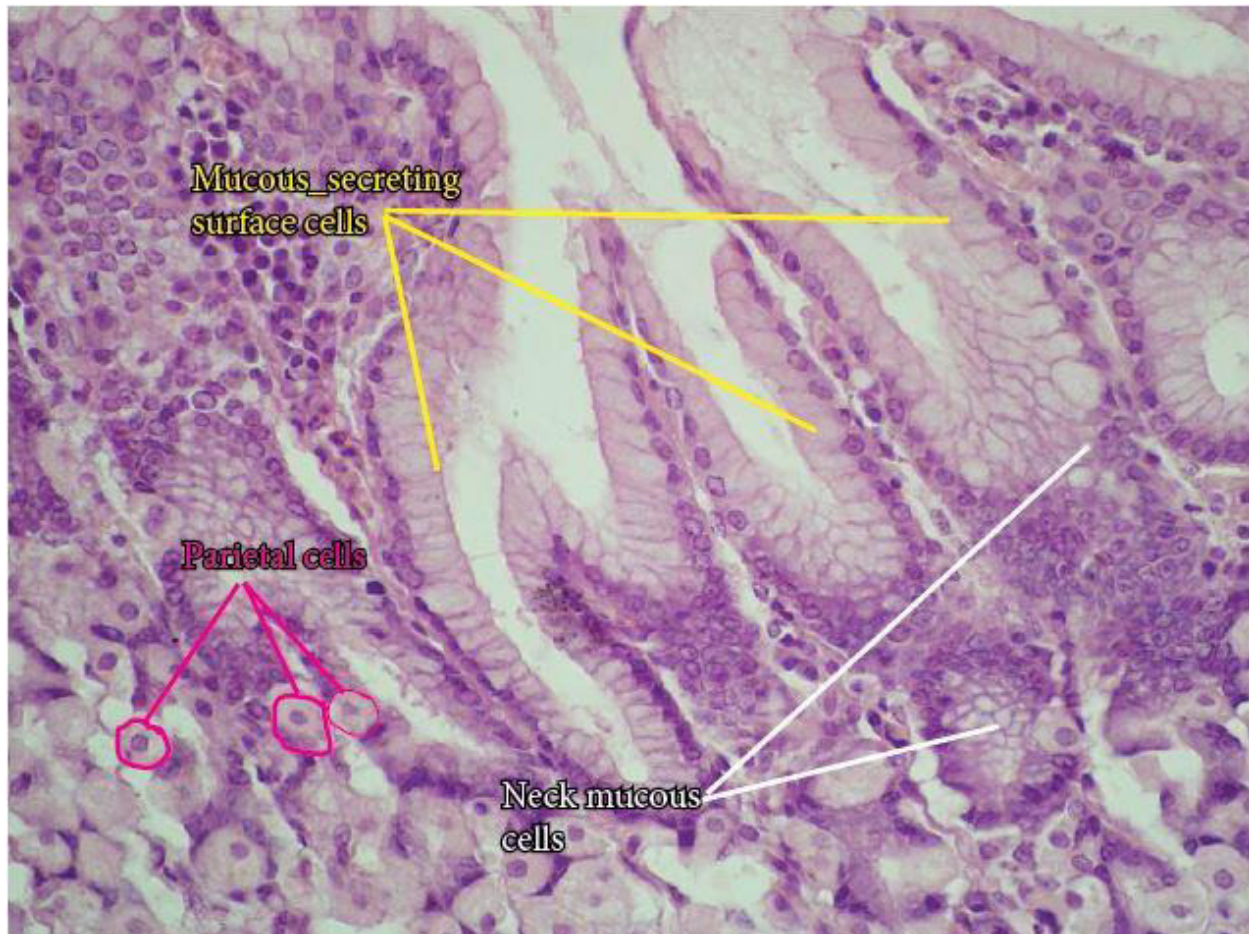
- Found at the base of the gastric gland.
- They are basophilic.
- Secrete pepsinogen, amylase and renin.

* **Parietal cells:**

- Rounded cells with central rounded nucleus.
- Found at neck of the gastric gland.
- They are acidophilic.
- Secrete HCl and intrinsic factors.
- It can be **binucleated**.

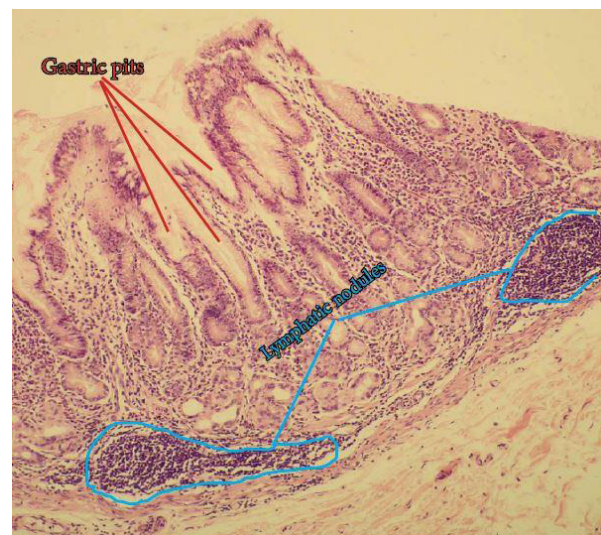


The slide below shows the gastric pits which are covered by simple columnar epithelial and most of them are mucous cells. You can see the **mucous cells** on the surface of the gland and within the gland (neck), these cells **have vacuoles** which give the cell **foamy appearance**.



Pylorus

- Lower part of the stomach
- It is important for filtration after digestion so it **contains lymphatic nodules in the lamina propria.**
- The gastric pit is long and the gland is short (gastric pit is longer than the gland)
- **Most of the gland's cells are mucous cells.**
- **No chief cells**
- **No parietal cells** (or very few)
- It also has muscularis mucosa, submucosa



and muscularis externa

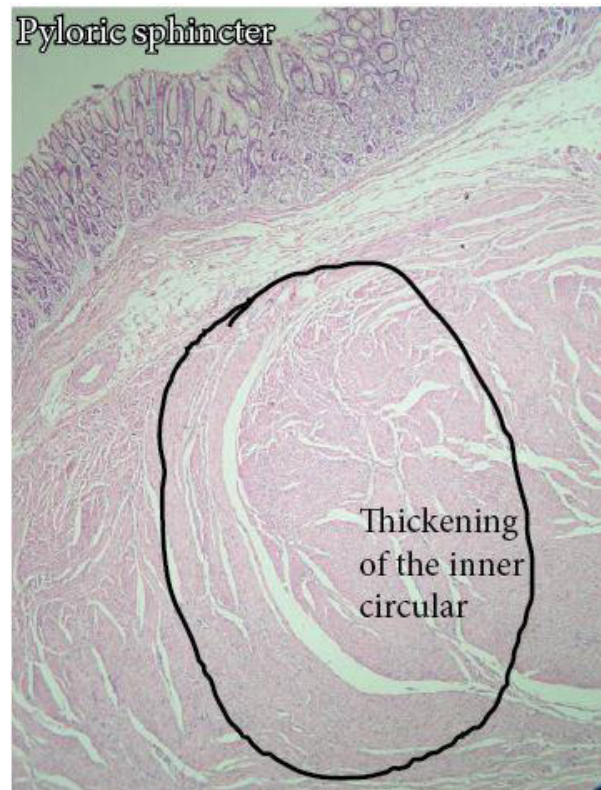
- There is a thickening in the inner circular layer of the muscularis externa to form the pyloric sphincter

- **Pyloric gland is simple branch tubular with coiling(not found in the body)**

- Most of the pyloric gland cells are mucus secreting cells and you can recognize the vacuoles and the foamy appearance of the cells.

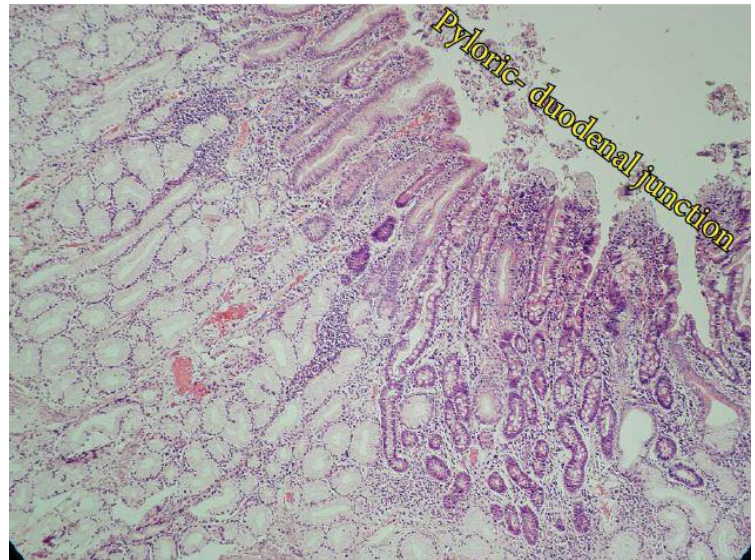


- The thickness of the inner circular and the outer longitudinal layer is the same in the body but at the sphincter there is thickening in the inner circular layer of the smooth muscle to form the sphincter; it is an **anatomical sphincter** -real thickening-.



Pyloroduodenal junction

- Change from the pylorus to the duodenum.



Small intestines:

Duodenum

- The mucosa forms **leaf like projections** (villi) but in the ileum and jejunum it forms finger like projections.
- The lamina propria extended into the projections (villi), and it contains connective tissue cells (such as: plasma cells and fibroblasts), smooth muscles and **lacteal which is blind ended lymphatic vessel and responsible for fat absorption.**
- The surface is covered by simple columnar epithelial cells; they can be secretory or absorptive cells, and goblet cells.
- The lining epithelial is **simple columnar epithelial and goblet cells** (white in color). –remember that there is no goblet cells in the stomach-



- The goblet cells have foamy appearance and vacuoles.
- It has also lymphatic nodules within the mucosa.
- The muscularis externa has 2 layers; inner circular and outer longitudinal.

*The duodenum has 2 types of glands (crypts of Lieberkuhn and Brunner's glands)

Crypts of Lieberkuhn/intestinal glands

- the glands change from gastric gland into crypts of Lieberkuhn –intestinal glands- which are found in the base of the projections.
- the base of the intestinal gland has **paneth cells** (this is special characteristic of small intestine, no paneth cells in the stomach or in the large intestine) they appear clearer in jejunum than duodenum.

Brunner's glands

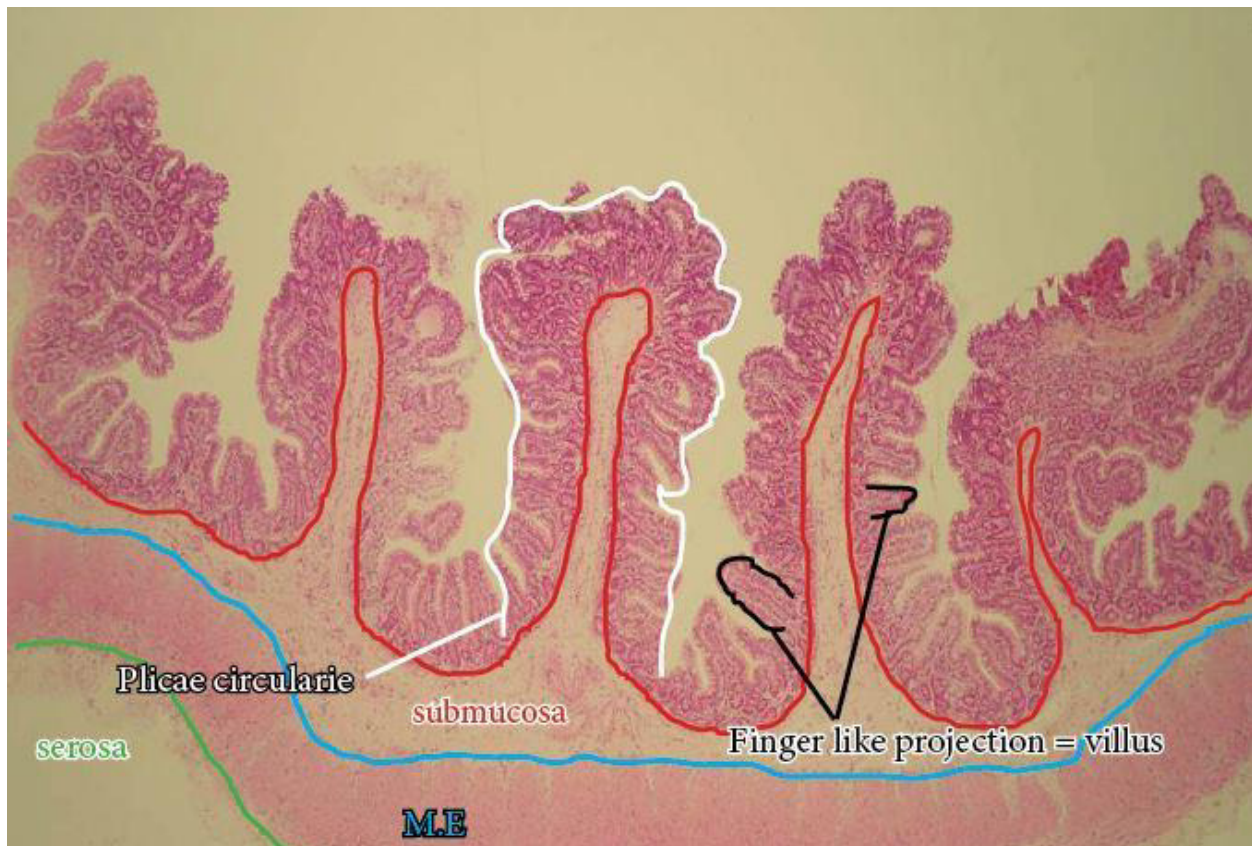
- found in the submucosa of the duodenum
- secrete alkaline mucus to neutralize the acidic chyme
- simple branched tubular glands

* Remember that the submucosal glands appear in the esophagus and the duodenum only.

- You can recognize the brush border -brush surface- which is formed by microvilli
- villi and microvilli increase the surface area.
- the brush border is found at the surface and appear faint in color under the LM
- **the myenteric plexus** (Auerbach's plexus) is found between the muscularis externa's layers; the inner circular and the outer longitudinal muscles, you can recognize some nerve cells (with nucleus and nucleolus), axons, and Schwann cells that surround the axons.

Jejunum

- It has finger like projections (villi) on the sides and the apex of the Plicae circularis which is an invagination of the submucosa through the mucosa.

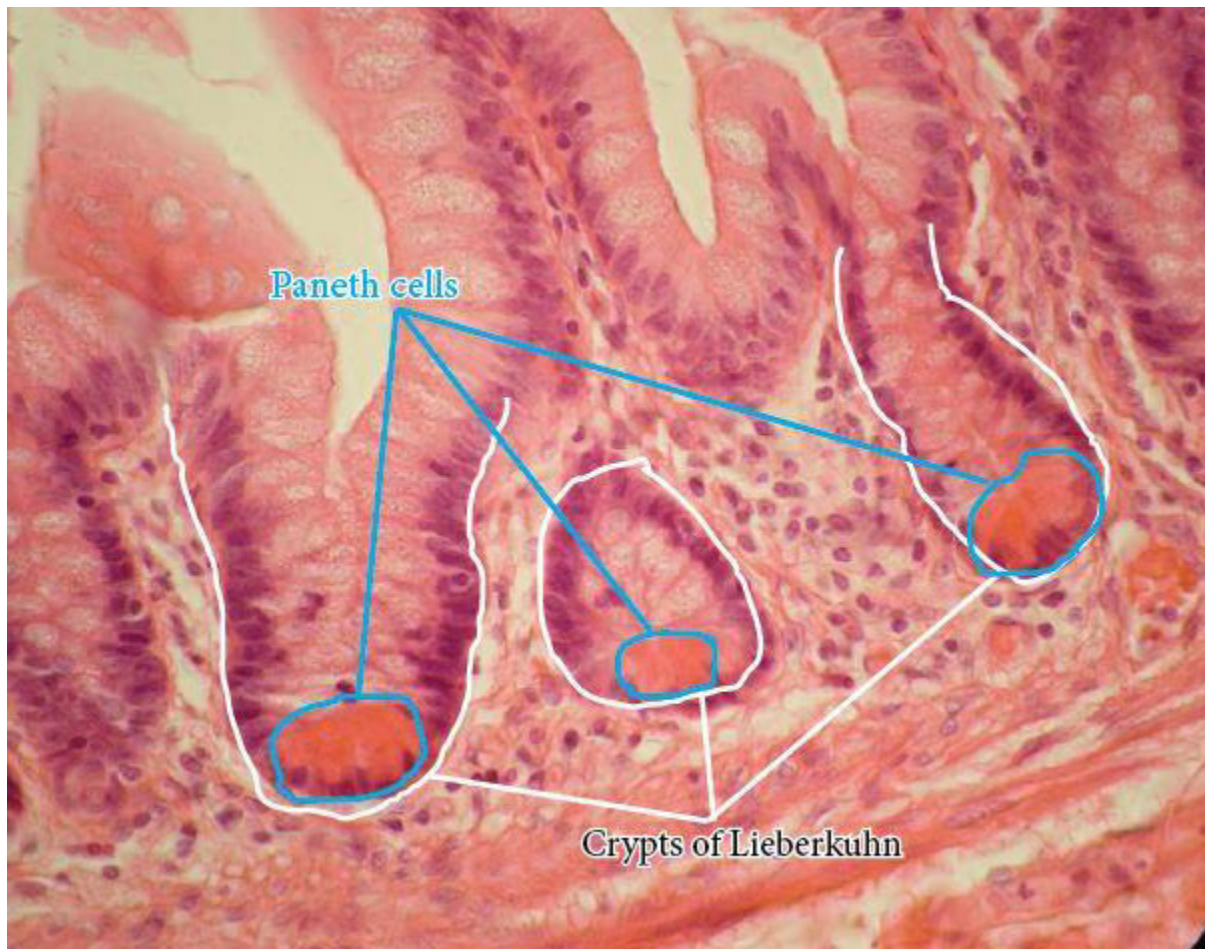


- it also has muscularis externa and **serosa** because the jejunum is completely covered by peritoneum
- it has **crypts of Lieberkuhn** at the base of the projection
- the surface is covered by **simple columnar epithelium with goblet cells** (same as duodenum)
- the main difference between duodenum and jejunum is that the finger like projections (villi) of the jejunum are located at the sides of the projections (plicae circularis)

- the plicae circularis is prominent andomezeh II jejunum

* paneth cell

- acidophilic (orange in color)
- found at the base of the gland (crypts of Lieberkuhn)
- it secretes lysozymes which are antibodies
- you can also recognize the lacteals in the lamina propria



- The appearance of the crypts of Lieberkuhn depends on the section that you have taken.

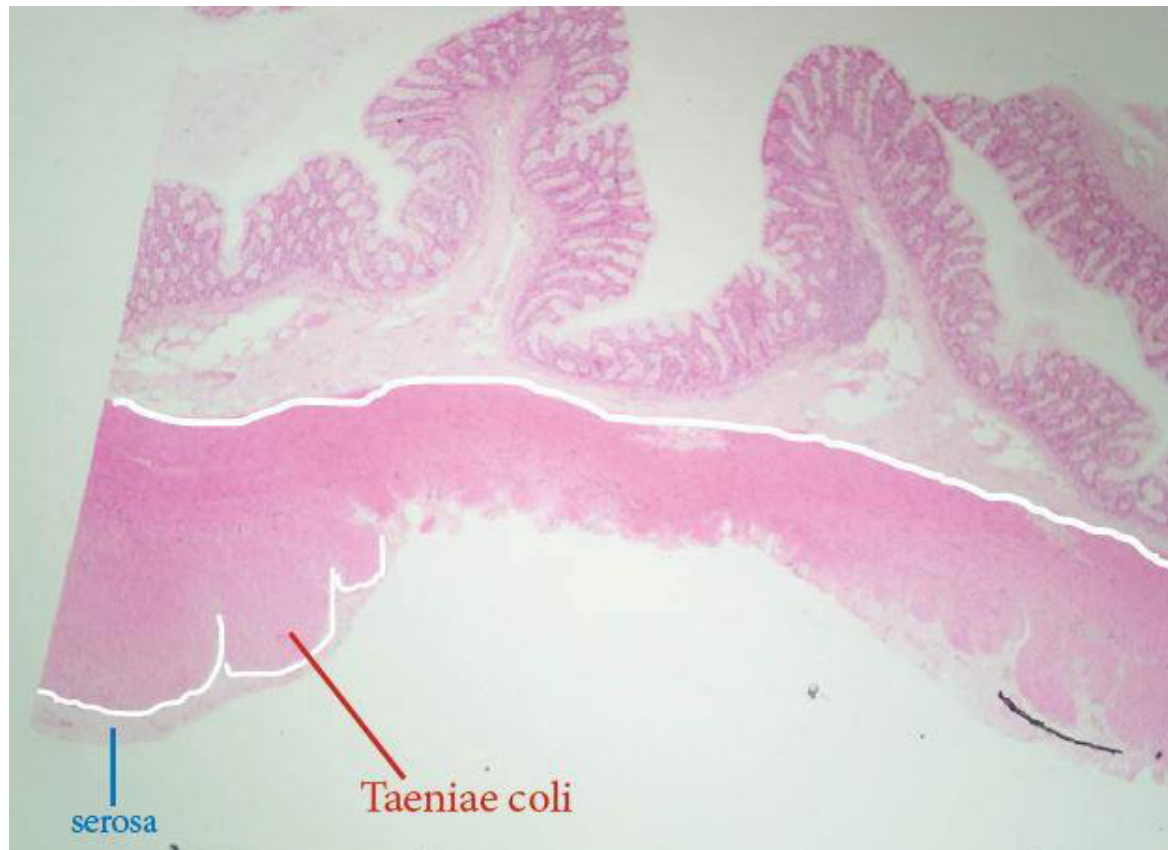
Ileum

- It has **Peyer's patches**; aggregation of large number of lymphocytes in the **lamina propria** (mainly) and they can infiltrate into the submucosa
- No Peyer's patches in the duodenum or the jejunum
- It has finger like projections and the lining epithelial is simple columnar epithelial with goblet cells (it looks like jejunum with some differences)

Large intestine:

- **large intestine** (cecum, ascending colon, transvers colon, descending colon, sigmoid and rectum) = **COLON**
 - the lining epithelial of the colon is **simple columnar epithelial and numerous goblet cells**
 - there is a huge number of goblet cells because of the need of lubrication for formation of feces
 - the **crypts of Lieberkuhn** are simple tubular gland and they reach the surface
 - **No villi** so the lining surface is smooth
 - it has **solitary nodules** in the lamina propria and they extend into the **submucosa** (mainly found in the submucosa)
- * remember Peyer's patches of the ileum; they are mainly found in the lamina propria with some filtration to the submucosa
- the **muscularis mucosa is well developed** in the large intestine and ill-defined in the small intestine
 - the surface is covered by mucus because most of the surface and glands cells are goblet and mucus secreting cells, all the simple columnar epithelial cells secrete mucus (they are white in color and vacuolated)
 - muscularis externa contains inner circular and outer longitudinal which forms the **Taeniae coli**
 - Taeniae coli: thickening of the outer longitudinal to form 3 longitudinal bands
 - **No paneth cells in the crypts of Lieberkuhn of the large intestine**

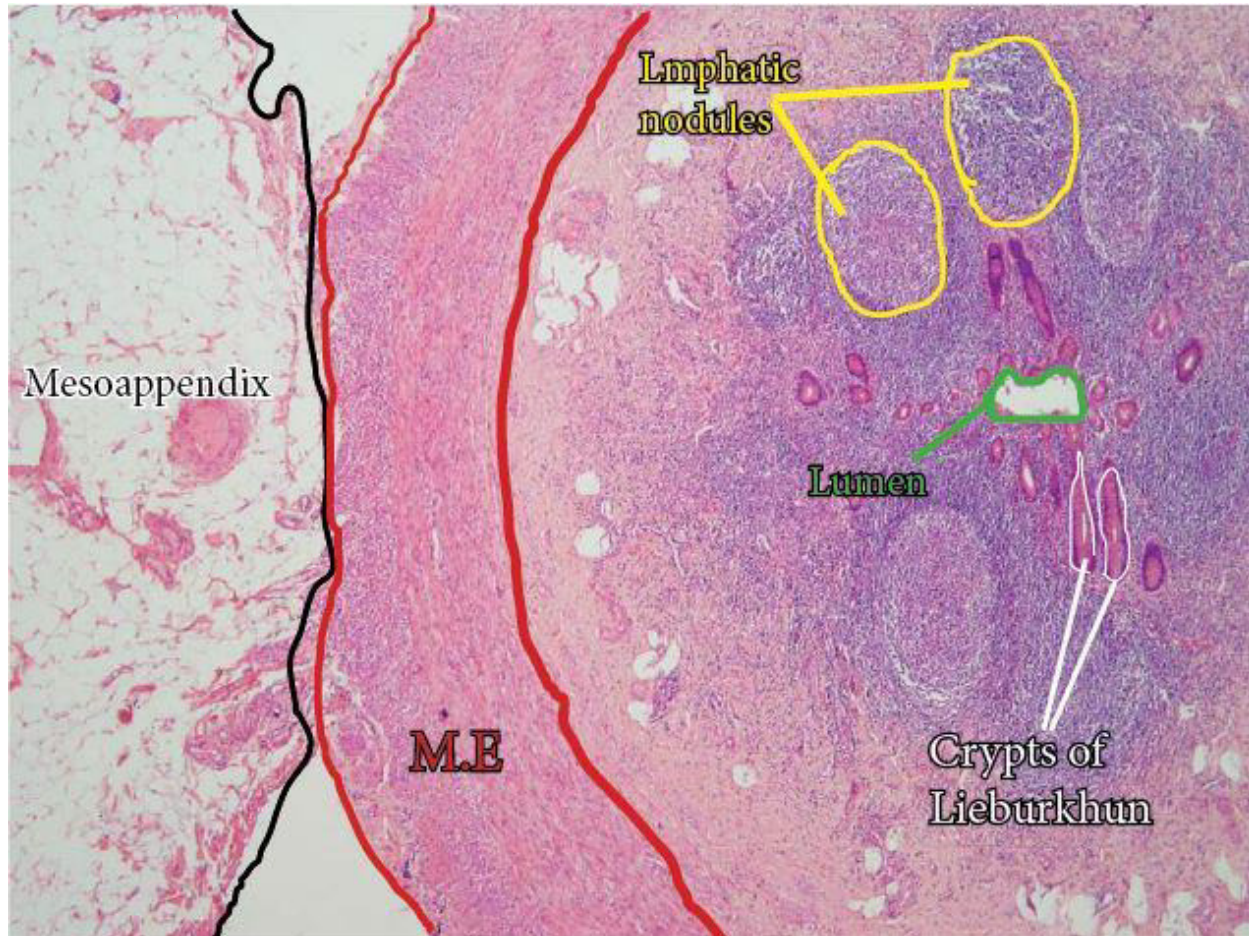
- the serosa of the colon has large amount of fat (fat cells) that forms **appendices epiploicae**



Appendix

- part of the large intestine
- has **very narrow lumen**
- the lining epithelium is simple columnar epithelial with very few goblet cells because there is no need for them
- few number of crypts of Lieberkuhn in the lamina propria
- the **appendix is lymphatic organ**, there is a huge number of lymphatic nodules in the lamina propria and they extend into the submucosa surrounding the wall of the lumen
- it has 2 layers of muscularis externa attached to the mesoappendix

- the **mesoappendix** contains large amount of fat and blood vessels from the appendicular artery.



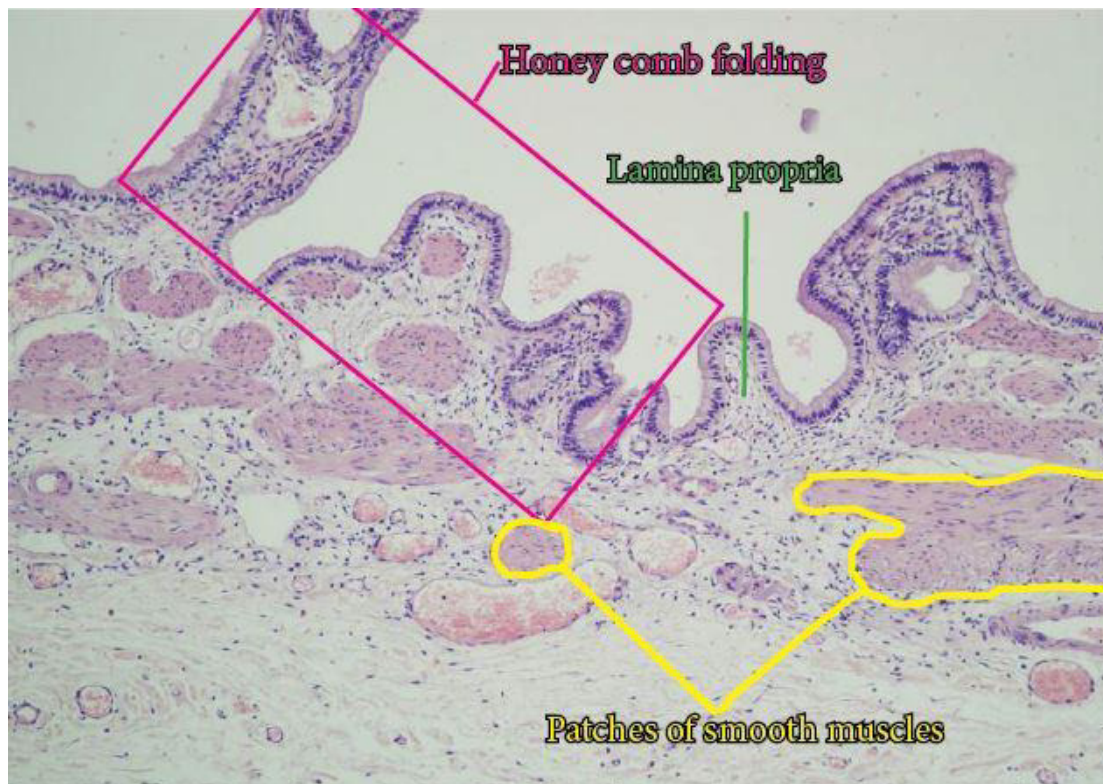
Rectoanal junction

- Change from the rectum to the anal canal
- * slides no. 110+111 → mosh darori na5do (not included)

Gallbladder

- the lining epithelium is **simple columnar without goblet cells**
- there is abundant of folding called **Honey comb folding** (زي خلية النحل) to increase the surface area for water absorption to concentrate the bile.

- **irregular muscularis externa** appears as patches of smooth muscles
- **absent muscularis mucosa**
- **absent submucosa** (or very thin) but **there is lamina propria**
- it has serosa or adventitia because the anterior surface and the lateral sides are covered by peritoneum (serosa), and the embedded surface with the liver has connective tissue (adventitia).

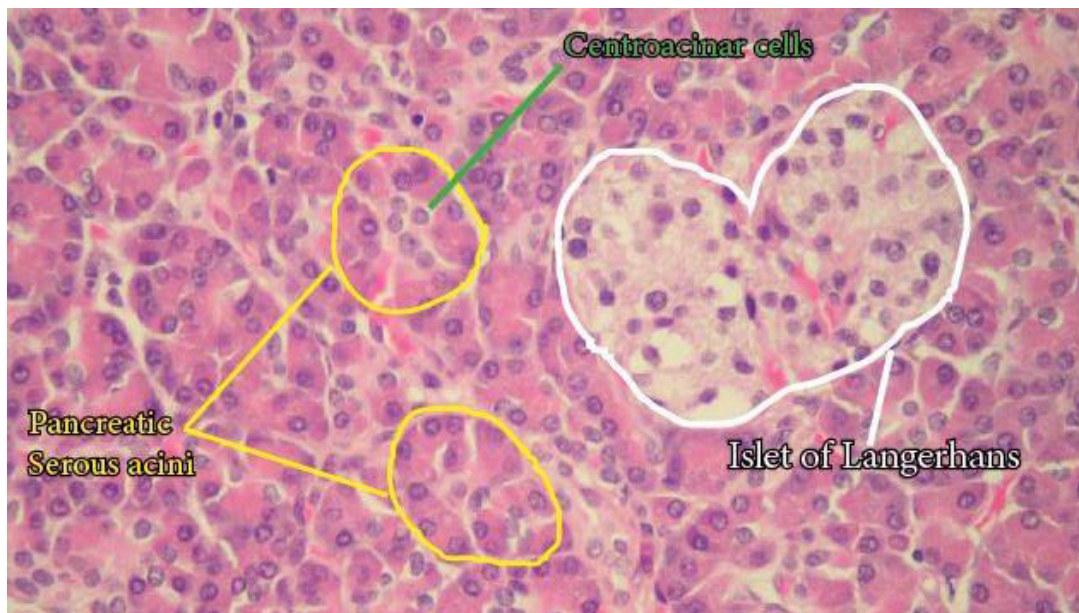


Pancreas:

- It is a mixed gland; endocrine and exocrine parts
- **Endocrine part** is represented by **Islet of Langerhans** (appear light in color under the microscopy)
- Islet of Langerhans has alpha and beta cells
- **Exocrine part** is represented by **pancreatic acini**
- pancreatic acini are compound acinar glands
- each acinar cell has basal nucleus with basophilic base
- **Polarity of pancreatic acini**→ the polarity is a characteristic of pancreatic acinar

cells which means that the cell has apical and basal end. At the apical part each acinar cell has zymogen granules (contain enzymes for secretion), and the basal part is basophilic.

- It has **centroacinar cells** which are bare cells with large nucleus and bare cytoplasm, and these cells are located between the acinar cells.
- It has **intercalated ducts** between the acini, the lining epithelial of the ducts is simple cuboidal epithelial.
- There are **no striated ducts** because the intercalated ducts drain directly in the pancreatic duct which starts from the tail to the head of the pancreas.

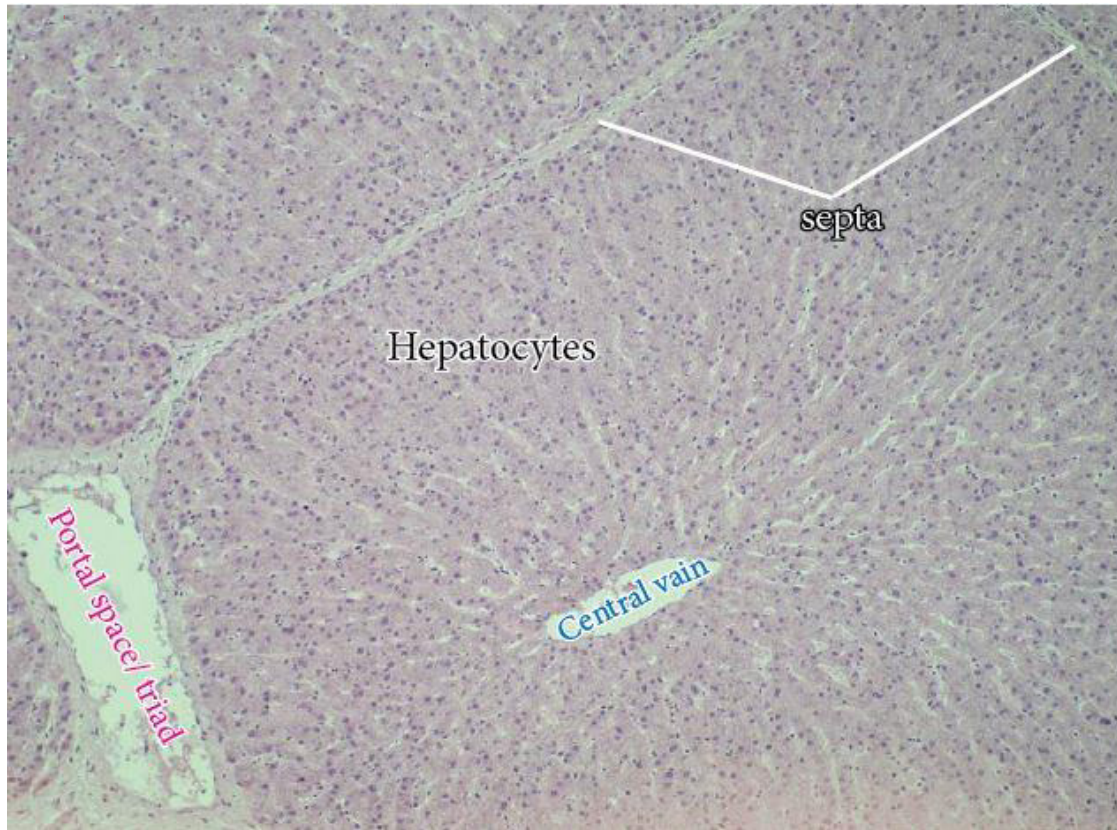


*slide 125→ they pointed the centroacinar cells as intercalated duct (so correct it, it is centroacinar cell not intercalated duct)

Liver:

- The liver is surrounded by Glisson's capsule; the capsule sends septa that divide the liver into hexagonal lobules
- In the slide below you can see:
the central vein, cord of hepatocytes which arrange radially toward the central vein

(this is called **parenchyma of the liver**), sometime the hepatocytes have double nuclei (**binucleated**), porta hepatis, septum, portal space or triad.



- The spaces on the side of one hepatocyte called sinusoid
- The lining endothelial cells of the hepatic sinusoid are fenestrated flattened endothelial cells

You have to differentiate between the different types of cells

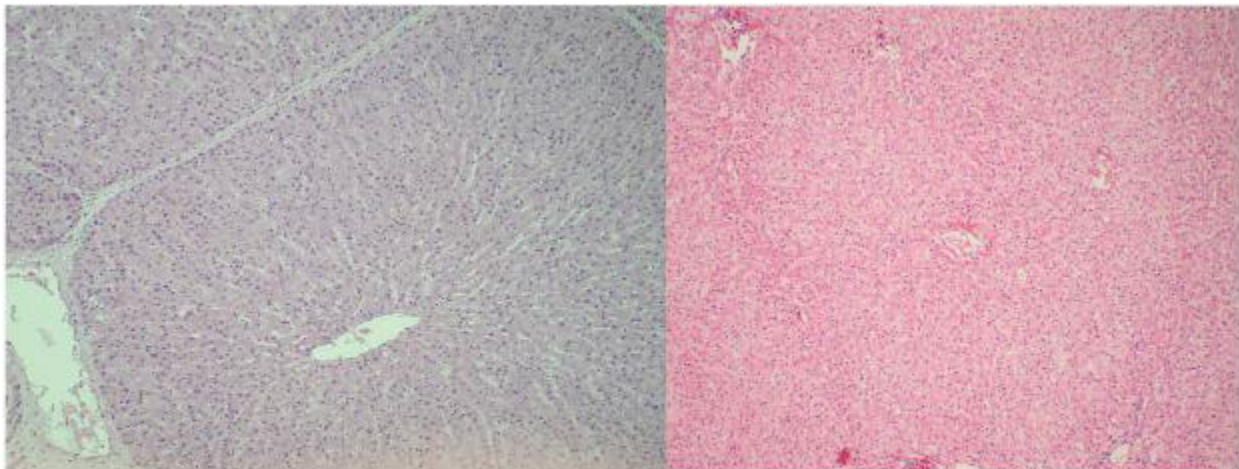
- *hepatocyte → rounded large nucleus
- *sinusoid lining cell → flattened endothelial cell
- *kupffer cell (phagocytic cell) → large and dark nucleus

Portal triad

It contains:

- **vein** (the largest one), from portal vein, the lining endothelial cells of the vein called mesothelium
- **artery**; from the hepatic artery
- **bile duct**; from bile canaliculi, the lining epithelial of the duct is simple cuboidal epithelial cells with 5-10 rounded nuclei
- **reticular fibers**
- **lymphatic vessels**
- **connective tissue**

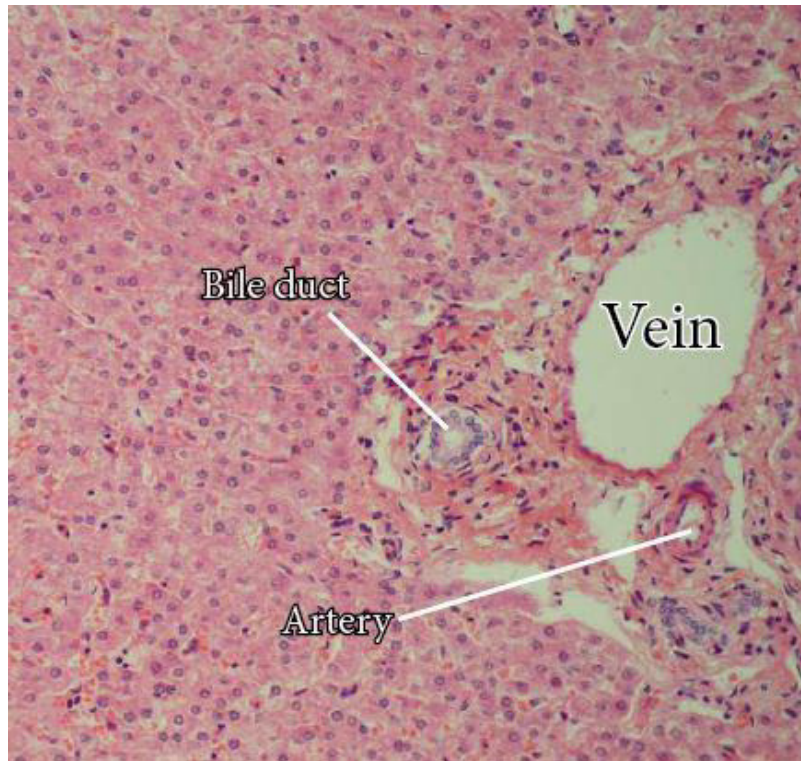
* The difference between the human liver and the animal liver is that the boundaries of the hexagonal are clear in the animal liver



Animal liver; the hexagonal boundaries are very clear

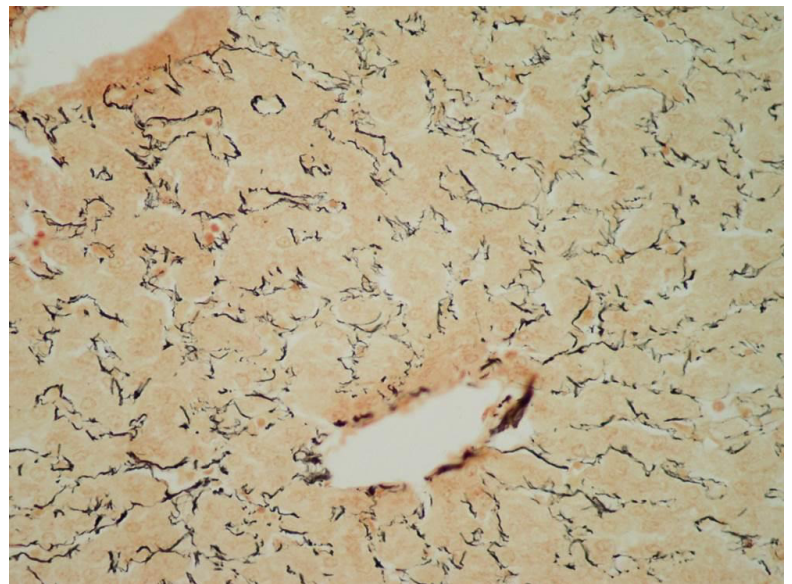
Human liver; you can see the central vein and the portal triads but the boundaries are not clear

* You can recognize the portal triad in the slide below, the vein is the largest one, the artery is red in color and the bile duct is violet in color



*Question in the exam,
they pointed the portal
triad and asked: it
contains all of the
following except?

Silver impregnation: special stain that is used to show the reticular fibers which are found around the central vein between the hepatocytes in the wall of space of disse and in the portal triad in the liver. In this slide you cannot see the hepatocytes but you can recognize the reticular fibers in the wall of sinusoid.

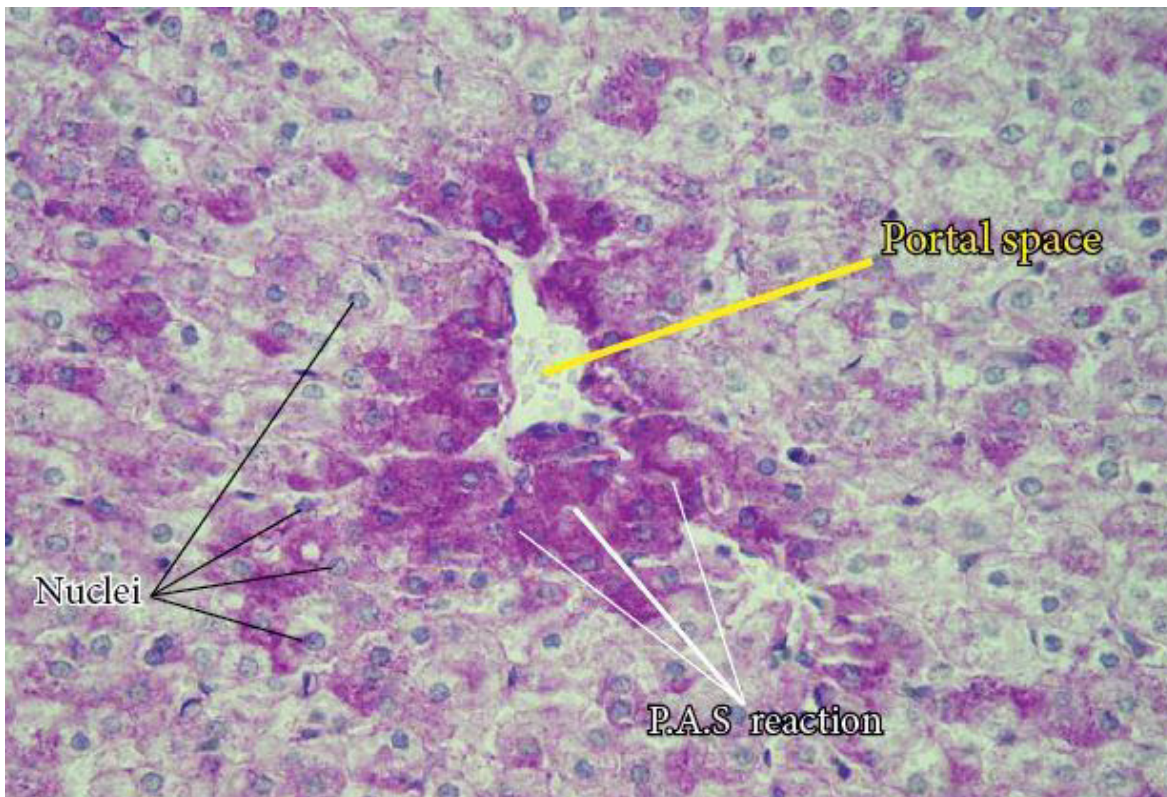


P.A.S reaction for glycogen

P.A.S: Periodic Acid Schiff stain

*As you know we store the glycogen in the liver and this storage depends on the abundance of the oxygen (more oxygen → more storage), so most of glycogen storage will be around the portal area (portal triads) and the cytoplasm of hepatocytes will be pinkish in color because of glycogen.

*the nuclei are violet or blue in color



Don't forget to refer to the slides

Sorry for any mistakes

Good luck in your finals